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Engineering the future

Deborah Greaves, Professor in Ocean Engineering and
Director of the Coast Laboratory, Plymouth University

It is an honour to be invited to write the editorial for the October 2016 edition of *The Plymouth Student Scientist*. This engineering-biased edition includes five papers from student engineers and is indicative of how the scope of the journal is widening and its efforts to attract more engineering contributions. It is also timely as it presents an opportunity to introduce the new School of Engineering, which will be launched in January 2017.

The formation of the new School of Engineering is an exciting step for Plymouth University (PU) and will allow us to raise the profile of engineering and awareness of its role across many areas in science and technology, and its contribution to finding solutions to the major challenges facing society today. It will allow engineering to grow and to strengthen its research and teaching, and indicates the University's commitment to the revitalisation of engineering as a whole. The new School will enhance the undergraduate experience by providing a strong focus on engineering, exploiting synergies and shared interests across the different strands of the discipline and finding new opportunities for students to engage in research and increase employability and skills.

The new School aims to be recognised as an internationally leading centre of excellence for teaching, research and development in engineering. Its vision is to provide excellent teaching with a balanced portfolio of postgraduate and professionally accredited undergraduate programmes, producing distinctive 'Plymouth Engineer' graduates with excellent employability. We have strong links with industry and one of the largest Industrial Advisory Committees in any UK University, who support our programmes with site visits, guest lectures and dissertation

project interviews. Undergraduate programmes include Civil Engineering with specialisation in Coastal Engineering, and Mechanical Engineering, with specialisation in Marine Technology, Composites and Manufacturing. Postgraduate Masters programmes are offered in Civil Engineering, Coastal Engineering and Marine Renewable Energy (MRE); a new MSc programme in Advanced Engineering Design is planned for 2017 and new areas for growth, for example with medicine and advanced manufacturing, are being explored.

Embedded as a significant contributor to the region and with strong industry engagement, engineering at Plymouth University provides research and development expertise and facilities for industry to access commercially and through collaboration in teaching and research. This model of industry-facing and research-informed teaching supported by well-equipped and supported laboratories and teaching spaces ensures sustainability and resilience and the ability to respond to industry need. The engineering discipline at PU is recognised for its excellent research with world class facilities and specialisation in key areas, and has an excellent research reputation in coastal and ocean engineering and MRE. Research in autonomous marine systems, structures and advanced materials and manufacturing are also well established with a long history of research and development.

However, the research interests of engineering academics and the range of student dissertation projects produced by the students is much broader than that. Dissertation topics within civil engineering range from studies of domestic flooding and protection, analysis of steel and concrete structures, scour around wind turbine foundations, earthquake loading, new concepts for wave energy, graphene based cement, novel fire-resistant concrete, soil slope stability and disaster management. In mechanical engineering, the topics cover tidal stream turbine design, materials for artificial joints, computer modelling of blood flow, ship hull design, lean engineering design, advanced manufacturing, failure analysis and control systems for autonomous marine vehicles. Each year, students team-up and use their dissertation projects to investigate novel systems for human powered submarine and hand powered cycle designs. These are then entered in international competitions, leading to a place on the podium for the inaugural submarine entry in 2014 and

a world speed record for a Human Powered Vehicle under arm-power alone in 2016.

Engineering is about finding technological solutions for the challenges facing society and improving peoples' lives. Some of the dominant challenges today include living with the impacts of climate change, the energy trilemma and infrastructure sustainability and some of the opportunities include big data, high performance computing, advanced materials, new energy systems and autonomous systems. Engineering students are encouraged to select a dissertation research project that is industrially relevant and tackles a real life problem, as well as allowing them to learn the scientific process of posing a research question and hypothesis; devising an experiment to gather evidence and carrying out scientific analysis. Many engineering students spend their penultimate year on placement in industry, and often this provides an excellent opportunity to follow up on their placement with a dissertation project back at the university. For example, Chris Ackland's placement on site constructing new cycle bridge across an environmentally sensitive area and access by barge under a mainline railway bridge, led to a first class dissertation project investigating solutions to bridge pier scour (1).

The world-class COAST laboratory and growth of the coastal engineering and MRE research area, is a good example of how teaching, research and commercial work can be combined to benefit one another. A sustainable coastline is critical to the UK as is developing MRE sources as an alternative to hydrocarbon-based energy. Through developing the COAST Laboratory and its activities, the coastal engineering team at Plymouth University are making an outstanding contribution to advancing MRE feasibility and to related ocean and coastal engineering in the UK and to training the new experts in the field. The COAST laboratory has unique capability for research and testing in MRE, both single devices and arrays, as well as for other offshore and coastal engineering work. The facilities are internationally leading and comprise: a large Ocean Basin with raisable floor, multi-directional waves and recirculating current in-line with and transverse to the waves; a Coastal Basin, with multi-directional waves and recirculating current; two glass-sided wave flumes with recirculating currents.

Since opening in 2012, the COAST facility has: supported projects for 32 external organisations, ranging across Universities, MRE developers, and miscellaneous clients; supported approximately 50 student research projects per annum, many in partnership with industry and hence increasing employability as well as research skills. The team have also won more than £4M in new research grants, leading to many internationally leading research outputs and had two thirds of their research judged as world-leading and of international repute in REF 2014. Working with industry partners and researchers in the COAST lab on their dissertation research projects has led, for some students, to joint research papers, placement opportunities and even to good job offers launching their engineering careers.

Building on the model of research informed teaching and industry collaboration developed by the COAST laboratory, and the strengths in teaching and research, together with strong industry engagement across civil and mechanical engineering, the new School of Engineering has a bright future!

References

1. **Ackland, Christopher.** *An investigation into the effects of rising seas levels on bridge pier scour at the inter-tidal River Clyst and Exe Estuary coastal interface.* s.l. : University of Plymouth, 2014. Final Year Dissertation.